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ABSTRACT

Candidates who had taken examinations for certification required by the American Production and Inventory Control Society (APICS) were surveyed to acquire feedback about the effectiveness of score interpretive information given to test takers. Those sampled included 488 passers and 389 failers of the Inventory Management (IM) examination and 457 passers and 419 failers of the Capacity Management (CM) examination given as part of the APICS testing program. The 416 IM and 479 CM candidates who completed and returned their questionnaires comprised the analysis sample. The clarity and usefulness of the score interpretive booklet were judged adequate by the candidates, although failed candidates gave less favorable evaluations than did passed candidates. Candidates deficient in one or more diagnostic content areas were very successful at correctly identifying these as the content areas requiring their concentrated study. Appendices contain content descriptions of the tests and the score interpretation questionnaire. Twelve tables give information about the test takers. (SLD)

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Evaluation of Score Interpretive Information from the Perspective of Failed and Passed Test-Takers

Gregory A. Shannon

American Council on Education

Paper presented at the Annual Meeting of the
American Educational Research Association
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Introduction

Although much information has been offered by administrators, diagnosticians, instructors and other professional about the effectiveness of score interpretive information provided to candidates who fail tests of certification or licensure, very little evaluative input has been obtained from candidates. This is unfortunate, since, candidates would be in an excellent position to answer some important questions about the usefulness and clarity of score interpretive materials. Score interpretive information refers to all documents candidates receive regarding the interpretation of their score reports. Such documents include descriptive inserts enclosed with score reports, candidate bulletins of information, and score reports that indicate measures of performance on the total test as well as on content-specific part-tests (e.g., diagnostic scores).

Motivated by a concern to help candidates interpret their score reports, the American Production and Inventory Control Society (APICS) provides its certification candidates with an extensive package of score interpretive information; some of this information includes:

- a score report showing two representations of test content performance: diagnostic part-test scores and subtest scores,
- diagnostic scores described as performance levels; i.e., scores 1 to 5, with each level representing a specified level of content knowledge deficiency (or competency),
- an outline containing a brief description of the content measured by each content-area score, and
- an explanation of the certification requirements at each of two levels: certified (lower level) and fellow (higher level).

The question of sufficiency of score interpretive information has been considered by many researchers (Hambleton and Eignor, 1979; Mills and Hambleton, 1980; Shannon, 1986). In the case of tests of licensure and certification, Shannon (1986) observed that the major emphasis is on candidates who fail the test. The Joint AERA, APA, NCME Standards for Educational and Psychological Testing addresses this issue by specifying Standard 11.4 as a primary standard. Standard 11.4 states that:

> "Test takers who fail a test should, upon request, be told their score and the minimum score required to pass the test. Test takers should be given information on their performance in parts of the test for which separate scores or reports are produced and used in the decision process." (Standards, 1985, p. 65)

Although the Standards 11.4 provides a general guide for considering what score interpretive information to convey to failed licensure or certification candidates, the specific information to report to these candidates must be determined by test users, test developers, and sponsors.

Minimum requirements for score interpretive information have been specified by internal auditors of Educational Testing Service (ETS) certification and licensure testing programs regarding their compliance with score interpretation guidelines of the ETS Standards of Quality and Fairness (ETS Standards, 1986; Shannon, 1986). These auditors recommended that total test scores (as opposed to mere notifications of failure) should be reported to failed candidates, to enable them to determine how close they came to passing the test; also, they recommended that score interpretive information issued to failed candidates include concise descriptions of content area measured by the test. At a minimum, according to the Chief Deputy Director of the California Department of Consumer Affairs (C. Foutz, personal communication, November 30, 1984), failed candidates (of licensure exams) should receive pass-fail decisions for subtests as well as for the total test.

To acquire feeback about the effectiveness of the score interpretive information, the American Production and Inventory Control Society expressed an interest in surveying a sample of APICS candidates. For this testing program, it would be advisable to sample essentially the same score interpretive materials. Because two passing standards are defined for each APICS test, many candidates who pass the lower standard (i.e., certified level) may fail to meet the higher standard (i.e., fellow level). Many candidates who pass a test at the lower standard but fail to pass the test at the fellow level may aspire to pass the test at the fellow level on a subsequent retesting; these candidates are similar to those who fail the test at the certified level and retest to attain a passing test score at the certified level. Thus, both passed and failed candidates at the certified level generally require the same sort of score interpretive information (SII).

Candidate feedback about the effectiveness of APICS score interpretive information might be useful in making further improvements to the existing SII, in addition to providing information that may lead to a better understanding of test-taking and test-preparation behaviors of candidates.

The objectives of the present study are to analyze the test results, biographical data, and questionnaire responses of candidates for certification as inventory and production control managers to:

1. identify indications about their perceptions of the usefulness and clarity of score interpretive information,

2. identify indications about their test preparation activities and

3. monitor the success of failed candidates at passing the test on their second attempt.

Method

APICS Tests

The APICS program administers the following five tests three times yearly:

Inventory Management
Production Activity Control
Capacity Management
Master Planning
Material Requirements Planning

Each test measures knowledge of one of five classes of job activities performed by members of the APICS (See Ahluwalia, 1985, for a readable description of these job activities with an example showing how they are interrelated). All tests are four-choice, 100-item multiple-choice tests. Each test consists of two or three subtests and five or six diagnostic part-tests.

Selection of APICS Tests for the Study

To contain the scope of the study to a manageable level, two of the five tests were selected: Inventory Management (IM) and Capacity Management (CM) tests. These tests were chosen in consideration of a concern raised during a recent ETS audit of the APICS testing program that some of the APICS diagnostic scores were based on too few items to yield reliable results. To address this issue, the test with the shortest (i.e., Inventory Management) and the longest (i.e., Capacity Management) diagnostic part-tests were selected. The IM test consists of five diagnostic part-tests, while the CM test consists of six

diagnostic part-tests; both tests are also partitioned into three subtests. A brief description of the content of each test (including the number of items assigned to each content area) is provided in Appendix A.

Although the main study focused on the November 1985 test administration, follow-up studies of candidates who failed in November continued for two subsequent administrations in April and July of 1986. Equivalent forms of each test were converted to a comparable score scale through score equating; thus, it was possible to compare test scores across test administration.

Certification Requirements Based on Test Performance

In addition to several non-test-related requirements for certification, candidates must meet the following requirements based on test performance. To be recognized as Certified in Production and Inventory Management, candidates must pass at least four of these tests at the certified level; to be recognized as a Fellow, Certified in Production and Inventory Management, candidates must pass at least three tests at the fellow level and pass all remaining tests at the certified level. Passing a test at the fellow level requires candidates to earn scaled scores of 85 or higher on the total test and 75 or higher on all subtests; passing can be achieved at the certified level by scoring at least 65 (scaled score) on the total test.

Definition of Passed and Failed Candidates

In this study, only the certified level standards will be used to define passed and failed candidates. Thus, the term passed candidates will refer only to candidates who passed a test at the certified level, while the term failed candidate will refer only to candidates who failed a test at the certified level.

Main Candidate Samples

The main samples consisted of 877 IM and 876 CM candidates tested on November 9, 1985, at testing centers located throughout the United States and six foreign countries. The IM sample consisted of 488 passers and 389 failers, and the CM sample consisted of 457 passers and 419 failers. For each test, candidates were selected to be in the main sample if they:

- took the test for the first time on November 9, 1985, and
- took the specified test (without also taking the other test in the study).

In addition, because the total candidate groups included more passed

candidates than failed candidates, passed candidates meeting the above criteria were selected randomly from the total group until the numbers of passed and failed candidates were approximately equal.

Analyses were based on first-time candidate groups, rather than on total candidate groups (i.e., first-time and repeater candidates) to avoid reliability and interpretation problems associated with repeater candidate scores. Beginning with the April 1987 test administration, all major analyses of APICS test results performed by Educational Testing Service will be based on first-time candidate groups.

Score Interpretation Questionnaire

The Score Interpretation Questionnaire (SIQ) asked candidates to respond to questions about the usefulness and clarity of the score report and the interpretive booklet, "Interpreting your APICS Score Report" and also questions about their study preparations. A version of the questionnaire was developed for each of the two APICS tests in the study; each version was color coded (i.e., blue = Inventory Management and salmon = Capacity Management). Copies of the SIQ designed for IM and CM candidates appear in Appendices B1 and B2, respectively; also listed are the percentages of responses entered by the total group of candidates in each analysis sample. The appropriate version of the SIQ was mailed to every candidate in the study, along with his or her score report, a score interpretive booklet and a return pre-posted envelope addressed to the author.

Return Rates for the Score Interpretation Questionnaire

Return rates are based on the total number of questionnaires completed and returned after one initial mailing and two follow-up mailings. As shown in Table 1, the percentage of questionnaires returned is 47% (416 of 877) for the IM sample and 55% (479 of 876) for the CM sample. The return rate for the IM sample was expected to be lower because the questionnaire designed for the IM candidates was longer by necessity (The Inventory Management version of the SIQ required candidates to provide information about more diagnostic content areas than did the Capacity Management version, six rather than five.)

Analysis Samples

The 416 IM and 479 CM candidates who completed and returned their questionnaires comprised the analysis samples. These samples were used to perform all major analyses.

Results

Representativeness of the Analysis Samples

The representativeness of the analysis samples as compared to the main samples is summarized in Table 2, in respect to pass-fail status, sex and test center location. These comparisons were made to identify any special considerations that should be taken into account when generalizing findings based on the analysis samples to the main samples. Overall, the results in Table 2 support the position that findings can be generalized to the main sample. The one special consideration, though a small one, is that the proportion of failed candidates is lower for the analysis samples than for the main samples; 6% lower for the IM sample and 10% lower for the CM sample. What this means is that failed candidates in both main samples returned their questionnaires at a lower rate than passed candidates. This result is not uncommon to studies that survey failed candidates; one explanation is that some failed candidates are more reluctant than passed candidates to participate in survey studies that might lead to further involvement with an experience (i.e., failing the test) which they may consider to be traumatic.

The Clarity and Usefulness of the Score Interpretive Booklet

In Item 1 of the SIQ candidates were asked to respond "yes" or "no" to questions about the clarity and usefulness of the explanations of 11 major topics described in the score interpretive booklet that accompanied their score reports; a "yes" response indicated a positive appraisal and a "no" response indicated a negative appraisal. The booklet explained topics such as scoring of reported scores (i.e., total, diagnostic and subtest scores), content measured by the reported scores, equating, the new score scale and passing levels.

The results are reported in Tables 3 and 4 for the IM and CM analysis samples, respectively. For both samples, the results indicate that the large majority of candidates considered the explanation of the topics covered in the booklet to be both understandable and useful in helping them determine how well they performed on the test. In both samples, 75% or more candidates judged 9 of 11 topics to be both clearly explained and usefully presented in the score interpretive booklet; the two exceptions were the topics "equating" and "the new score scale."

These findings indicate that he IM and CM candidates considered the score interpretive booklet to be clearly written and useful for helping them to interpret their score reports. The explanations of the two most technical topics described in the booklet, "equating" and "the new score scale," appear to require some improvement.

Usefulness of Subtest and Diagnostic Score Information

Perhaps the most important score interpretive information provided to APICS candidates is information about their performance in the specific content areas measured by the test. On the IM and CM tests, content-area performance is measured by subtest and diagnostic part-test scores. To consider candidates' perceptions of the effectiveness of this information, responses to SIQ items pertaining to the usefulness of subscore and diagnoatic score information were examined as a group. Items 1BII, 1CII, 1DII and 1EII asked about the usefulness of subtest and diagnostic score information presented in the score interpretive booklets, and items 2AII and 2DII asked about the usefulness of subtest and diagnostic score information presented on score reports. The results are presented in Tables 5 and 6 for the IM and CM analysis samples, respectively.

The results indicate that the large majority (i.e., 75% or more "yes" responses) of all APICS candidates considered each type of subtest and diagnostic score information presented in the interpretive booklets and the score reports to be helpful in interpreting their score results. Candidates found the explanations of the scoring of the subtests and diagnostic part-tests on the interpretive booklet to be the most useful (averaging about 83% "yes" responses), while considering the booklet descriptions of the content of the diagnostic part-tests to be the least useful (averaging 77% "yes" responses). These results apply about equally well to both the IM and the CM samples.

Although both passed and failed candidates were generally favorable in their evaluations of the usefulness of the subtest and diagnostic score information, failed candidates were consistently less favorable than passed candidates. For every item, in Tables 5 and 6, the percentage of "yes" responses is lower for failed candidates than for passed candidates; with an average difference of about 9%.

Variables that Distinguish Passing and Failed Candidates

To identify characteristic differences between passed and failed candidates, these two groups were compared on the more than 50 questionnaire, biographic and score variables for which data were available. Discriminant analyses were performed to make initial selections of variables on which passed and failed candidates differed widely; variables for which chi-square comparisons were not significant at the 1% level were eliminated from the final lists. The final lists of variables are reported in Tables 7 and 8 for the IM and CM samples, respectively, ranked in order of the size of the differences between means as measured by chi-square values. To simplify interpretation of the diagnostic results for this study, the original diagnostic score scale was modified to define scores ranging from 1 to 3 as "acceptable" and scores 4 and 5 as "unacceptable;" consistent with the instructions provided to candidates (in the score interpretive booklets) regarding the interpretation of diagnostic part-test scores.

When compared with failed candidates in the IM sample, passed candidates in this sample scored much higher on diagnostic part-tests 1 (Objectives and Decisions) and 5 (Independent and Dependent Inventory Systems); evaluated the usefulness of booklet explanations of the total test content, subtest scoring and content more favorably; considered the booklet explanation of equating to be clearer; were more likely to have studied on their own in preparation for the test; and were more likely to be male. Passed candidates in the CM sample (as compared with failed candidates in the CM sample) scored much higher on diagnostic part-tests 5 (Techniques of Control) and 3 (Lead-time Management) and evaluated the usefulness of booklet explanations of subtest scoring, total test scoring and subtest content more favorably.

The fact that passed and failed candidates' performance differ so widely on these diagnostic part-tests indicates that these part-tests discriminated well between these candidate groups; these test sections, in particular, served effectively at classifying candidates as passers or failers. Further studies should be conducted to determine if these sections will continue to be the strongest classification measures across different forms of the IM and CM tests. If so, this may lead to several benefits such as improved test reliability (i.e., consistency at which candidates are classified into pass-fail categories) and sharper conceptual definitions of minimally competent candidate, to improve the accuracy of cut score study results.

Study Activities Performed in Preparation for Testing

Question 5 of the SIQ asked candidates to indicate which study activities (e.g., taking a college course) they pursued in preparing for the test given in November 1985 and also to identify the activities they would pursue if they were to take the test for the second time. The percentages of candidates who selected each study activity for one or more diagnostic content area are presented in Tables 9 and 10 for the IM and CM samples, respectively. Also presented for each activity is the net change in study strategy (i.e., the percentage of candidates who indicated that they had performed the activity minus the percentage of candidates who indicated that they would perform the activity if retested).

Listed in order of preference, the study activities most preferred by candidates are: (1) studying on one's own, (2) using the APICS study-guide references, and (3) attending an APICS seminar. Remarkably, this order of preference is the same for both the IM and CM samples, both passed and failed candidates, and both test preparation conditions (i.e., preparation for the initial testing in November 1985 and preparation for a retesting). The percentages of candidates who indicated that they had either performed or would perform these three prevalent study activities range from 65% to 81% for self-study, 42% to 65% for study-guide references and 32% to 47% for APICS seminars. (The reader is advised to be careful when interpreting any results involving APICS seminars, since the term APICS seminar refers to a collection of seminars designed and operated

either by individual APICS chapters or by the national office.)

The least preferred study activity is attending a non-APICS seminar. The percentages of candidates who indicated that they either attended or would attend a non-APICS seminar range between 8% and 12%.

Also of interest are changes in study strategies candidates had used initially to prepare for the November 1985 testing. The largest positive shifts in study strategy occurred for the use of the APICS study-guide references; in that, between 10% and 16% of the candidates who had not used study-guide references to prepare for their first testing indicated that they would do so to prepare for a second testing. The next largest positive shifts in study strategy were observed for participating in study groups; between 4% and 9% of the candidates who had not used this activity to prepare for the November testing indicated that they would participate in a study group to prepare for a retesting.

Although candidates considered studying on one's own to be the most preferred study activity, some noteworthy negative shifting in study strategy occurred for this activity. With the exception of failed IM candidates, between 9% and 14% of the candidates indicated that they would drop self-study as a study activity if retested.

Percentages of Candidates Who Correctly Interpreted Their Knowledge Deficiencies

An important question to ask about the usefulness of score interpretive information is: "From the information provided, can candidates correctly interpret diagnostic part-test results that show knowledge deficiencies?" A correct interpretation of a deficient diagnostic result is operationally defined as the event in which a candidate receives an unacceptable diagnostic part-test score (i.e., scaled score of 4 or 5), and indicates on item 3 of the SIQ that he or she would target study on this diagnostic part if studying for retesting. Presented in Table 11 for each diagnostic part-test are the percentages of the candidates who performed deficiently on the diagnostic part area and correctly interpreted their results.

The percentages of correct interpretations range from 72% to 84%, across both the IM and CM samples, indicating that most of the candidates had correctly interpreted their deficient diagnostic results. This finding suggests that the score interpretive information pertaining to the diagnostic part-test scores appears to be effective. This is probably the most critical aspect of the score interpretive information provided to candidates.

The percentages of correct interpretations are about the same for passers and failers of the total test; none of the chi-square tests (Yates-corrected) comparing these groups were significant at the 5% level. This finding supports the current practice of reporting the same form of diagnostic score interpretive information to passed and failed candidates. Neither group should have an advantage; all candidates should be able to correctly interpret the score information

provided to them, regardless of how well they scored on the test.

Performance of Retested Candidates

This study monitored failed candidates for the two test administrations following the November 1985 administration; these subsequent testings occurred in April and July 1986. Only about a third of the candidates in the IM and CM analysis samples who had failed in November 1985 retested during this eight-month period; 32% (50 of 158) of the failed IM candidates and 36% (66 of 181) of the failed CM candidaes were retested. (Follow-up questionnaires were mailed to all failed candidates in the analysis samples; however, the numbers of completed questionnaires returned by the candidates were insufficient for meaningful statistical analysis.)

The test results of these retested candidates are summarized in Table 12. Only candidates' scores on the second testing were included in the analyses (Only the April scores of candidates who retested both in April and July were included). As a group, the retested candidaes made significant gains in test performance; 50% of the IM candidates and 42% of the CM candidates passed on the second testing. Gains in total test scaled scores were strong throught the range of scores, with an average gain of about five scaled-score points; even those who failed a second time improved their test performance.

The reader is cautioned against expecting failed candidates in general to attain such gains in test performance. The retested candidates were self-selected groups, unrepresentative of all failed candidates in the analysis samples; the retested candidates comprised only about a third of all failers and they differed from the non-retested failers characteristically, most noteably in respect to performance on the November 1985 test. Retested candidates' test scores exceeded those of non-retested candidates by an average of 2.8 scaled-score points for the IM sample and 4.4 scaled-score points for the CM sample; both differences are significant at the 1% level. Since the retested candidates had out-performed the non-retested candidates on the first testing, it would be reasonable to expect them to do likewise on the second testing.

Conclusions

The candidates in the Inventory Management and Capacity Management analysis samples strongly favored the usefulness and understandability of the score interpretive information which they received from the American Production and Inventory Control Society. Although failed candidates were quite positive about the effectiveness of the interpretive information, they were consistently less positive than passed candidates. The only score interpretive information that the candidates did not evaluate favorably were the explanations of score equating and the new score scale provided in the score interpretive booklet; although these concepts are very technical, some additional improvements in the clarity of their explanation may be warranted.

Candidates who were deficient in one or more diagnostic content areas were very successful at correctly identifying these as the content areas requiring their concentrated study. This finding provides convincing evidence for the effectiveness of the diagnostic score interpretive information.

Except for differences in test performance and evaluations of the score interpretive materials, few differences were found between passed and failed candidates. These two groups of candidates preferred the same study activities and were similarly effective at correctly identifying these as the content areas requiring concentrated study.

Failed candiates did reasonably well at passing their tests on the second try. However, these candidaes were not typical of most failed candidates in that they were probably among the most talented of the candidates who had failed their test on the first attempt.

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APPENDICES

Appendix A: Brief Content Descriptions of the APICS Inventory Management and Capacity Management Tests

	No. of Items
Inventory Management Test	
Subtests	
1 - General Inventory Management	35
2 - Inventory Management Systems	45
3 - Distribution Inventory Management	20
	100
Diagnostic Part Tests	
1 - Objectives and Decisions	15
2 - Accounting and Control, Inventory Management and Business Functions	20
3 - Inventory Systems Development	12
4 - Lot-Size Inventory Models	14
5 - Independent and Dependent Demand Inventory Systems	19
6 - Distribution Inventory Management	20
	100
Capacity Management Test	
Subtests	
1 - Concepts, Application and System Interfaces	20
2 - Capacity Determination and Lead-time Management	35
3 - Techniques of Planning and Controls	45
	100
Diagnostic Part Tests	
1 - Concepts and Application System Interfaces	20
2 - Capacity Determination	16
3 - Lead-time Management	19
4 - Techniques of Planning	21
5 - Techniques of Control	24
	100

Appendix B1: Score Interpretation Questionnaire Completed by APICS Inventory Management Candidates, Showing Percentages of Response to Each Question

APICS SCORE INTERPRETATION QUESTIONNAIRE
FOR CANDIDATES WHO TOOK THE INVENTORY MANAGEMENT EXAMINATION

To the APICS Candidate:

The attached questionnaire is being sent to a random sample of APICS candidates who took the Inventory Management examination for the first time in November 1985. We hope that you will take the time required--about 10 minutes--to complete it. The purpose of the questionnaire is to help the American Production and Inventory Control Society assess the clarity and usefulness of the score reports and accompanying interpretive information. It is therefore important to us to have your reactions to these materials.

The questionnaire is designed to provide us with information about the success of the materials in helping you understand how well you performed on the test. Since the questions refer to your score report and to the booklet entitled "Interpreting Your APICS Score Report," please read these documents before you complete the questionnaire.

You will notice that your questionnaire has an identification number. We have done this in order to be able to cross your name off our mailing list when your questionnaire is returned. Please be assured your name will not appear on the questionnaire or on any reports. Return your completed questionnaire in the enclosed postage-paid envelope.

Your responses will be treated as confidential.

Thank you for your help.

Note. No percentages of responses are shown for the "Other" category for any of the questions because of insufficient response rates; fewer than 1% of all candidates in the analysis sample ever responded to this category.

1. This part of the questionnaire is about the booklet "Interpreting Your APICS Score Report." Please answer Questions I and II separately for each topic. (Check YES or NO for Question I and for Question II on each line.)

TOPIC	QUESTION I: IS THIS TOPIC EXPLAINED CLEARLY IN THE BOOKLET? YES	QUESTION I: NO	QUESTION II: WAS THE TREATMENT OF THIS TOPIC IN THE BOOKLET USEFUL IN HELPING YOU DETERMINE HOW WELL YOU PERFORMED ON THE TEST? YES	QUESTION II: NO
A. Total Scores: explanation of numbers (p. 1)	92%	8%	89%	11%
B. Subscores: explanation of numbers (p. 1)	90%	10%	85%	15%
C. Subscores: description of content (pp. 2-3)	87%	13%	83%	17%
D. Diagnostic Scores: explanation of numbers (p. 1)	88%	12%	84%	16%
E. Diagnostic Scores: description of content (pp. 2-3)	85%	15%	79%	21%
F. Passing Scores at Fellow Level (p. 1)	95%	5%	90%	10%
G. Passing Scores at Certification Level (p. 1)	98%	2%	93%	7%
H. Equating (p. 1)	79%	21%	64%	36%
I. New Scale (p. 1)	72%	28%	61%	39%
J. Certification as a CPIM (p. 4)	97%	3%	86%	14%
K. Certification as a CFPIM—Fellow (p. 4)	96%	4%	84%	16%
L. Other: (Specify below.)				
.....	----	----	------	------

2. This part of the questionnaire is about your score report. Please answer Questions I and II separately about information provided on your score report. (Check YES or NO for Question I and Question II on each line.)

INFORMATION INCLUDED ON YOUR SCORE REPORT	QUESTION I: WERE YOU ABLE TO IDENTIFY/LOCATE THIS INFORMATION ON YOUR SCORE REPORT? YES	QUESTION I NO	QUESTION II: DOES THE PROVIDED INFORMATION HELP YOU TO IDENTIFY TEST CONTENT AREAS FOR ADDITIONAL STUDY? YES	QUESTION II NO
A. Your Subscores	99%	1%	81%	19%
B. Your Total Test Scores	100%	0%	71%	29%
C. Your Pass/Fail Outcome	100%	0%	72%	28%
D. Your Diagnostic Scores	99%	1%	85%	15%
E. Other: (Specify below.)				
_____	____	____	____	____

THE REMAINDER OF THE QUESTIONNAIRE IS ABOUT THE INVENTORY MANAGEMENT EXAMINATION.

3. If you were preparing to take the Inventory Management examination for a second time, on which diagnostic content would you concentrate your studies? (Check as many as apply.)

A. Diagnostic 1 51%
B. Diagnostic 2 48%
C. Diagnostic 3 58%
D. Diagnostic 4 55%
E. Diagnostic 5 43%
F. Diagnostic 6 63%

Why? _____

_____

_____

4. Are you planning to take the Inventory Management examination again? (Check YES or NO.)

YES 39% NO 61%

5. This page of the questionnaire is about your preparation for each diagnostic content area of the Inventory Management examination. Check as many boxes that apply separately for Question I and Question II, on each line.

		Question I: Which study activities did you perform to prepare for the Inventory Management exam?						Question II: Which study activities would you perform if you were preparing to take the Inventory Management exam for a second time?					
		DIAGNOSTIC						DIAGNOSTIC					
	STUDY ACTIVITY	1	2	3	4	5	6	1	2	3	4	5	6
A.	Attend/attended an APICS seminar or workshop	42%	41%	41%	41%	41%	39%	39%	39%	39%	34%	39%	38%
B.	Attend/attended a non-APICS seminar or workshop	10%	9%	9%	9%	9%	9%	8%	7%	7%	7%	7%	7%
C.	Participate/participated in an informal study group	14%	14%	14%	14%	14%	13%	20%	20%	20%	20%	19%	20%
D.	Study/studied on your own, not with a group	73%	71%	70%	71%	70%	68%	67%	66%	67%	65%	66%	65%
E.	Attend/attended a regular college course	13%	12%	12%	13%	13%	11%	8%	9%	9%	9%	9%	9%
F.	Study/studied the references listed in the Study Guide	44%	42%	42%	44%	43%	41%	56%	56%	57%	57%	55%	57%
G.	Other: (Specify below.)												

Note. Entered in each box is the percentage of candidates in the analysis sample who entered a check mark in the box.

6. Did you pass the Capacity Management examination at the certification level? (Check YES or NO.)

YES 62% NO 38%

If you did NOT pass the Capacity Management examination at the certification level, why do you think you did not? Provide as many reasons as you feel are applicable.

THANK YOU FOR YOUR COOPERATION.

Please return the completed questionnaire in the enclosed, self-addressed, stamped envelope.

Appendix B2: Score Interpretation Questionnaire Completed by APICS Capacity Management Candidates, Showing Percentages of Responses to Each Question

APICS SCORE INTERPRETATION QUESTIONNAIRE
FOR CANDIDATES WHO TOOK THE CAPACITY MANAGEMENT EXAMINATION

To the APICS Candidate:

The attached questionnaire is being sent to a random sample of APICS candidates who took the Capacity Management examination for the first time in November 1985. We hope that you will take the time required--about 10 minutes--to complete it. The purpose of the questionnaire is to help the American Production and Inventory Control Society assess the clarity and usefulness of the score reports and accompanying interpretive information. It is therefore important to us to have your reactions to these materials.

The questionnaire is designed to provide us with information about the success of the materials in helping you understand how well you performed on the test. Since the questions refer to your score report and to the booklet entitled "Interpreting Your APICS Score Report," please read these documents before you complete the questionnaire.

You will notice that your questionnaire has an identification number. We have done this in order to be able to cross your name off our mailing list when your questionnaire is returned. Please be assured your name will not appear on the questionnaire or on any reports. Return your completed questionnaire in the enclosed postage-paid envelope.

Your responses will be treated as confidential.

Thank you for your help.

Note. No percentages of responses are shown for the "Other" category for any of the questions because of insufficient response rates; fewer than 1% of candidates in the analysis sample ever responded to this category.

1. This part of the questionnaire is about the booklet "Interpreting Your APICS Score Report." Please answer Questions I and II separately for each topic. (Check YES or NO for Question I and for Question II on each line.)

TOPIC	QUESTION I: IS THIS TOPIC EXPLAINED CLEARLY IN THE BOOKLET? YES	QUESTION I: NO	QUESTION II: WAS THE TREATMENT OF THIS TOPIC IN THE BOOKLET USEFUL IN HELPING YOU DETERMINE HOW WELL YOU PERFORMED ON THE TEST? YES	QUESTION II: NO
A. Total Scores: explanation of numbers (p. 1)	92%	8%	85%	15%
B. Subscores: explanation of numbers (p. 1)	88%	12%	82%	18%
C. Subscores: description of content (pp. 2-3)	83%	17%	77%	23%
D. Diagnostic Scores: explanation of numbers (p. 1)	90%	10%	84%	16%
E. Diagnostic Scores: description of content (pp. 2-3)	80%	20%	75%	25%
F. Passing Scores at Fellow Level (p. 1)	97%	3%	86%	14%
G. Passing Scores at Certification Level (p. 1)	97%	3%	88%	12%
H. Equating (p. 1)	73%	27%	60%	40%
I. New Scale (p. 1)	69%	31%	59%	41%
J. Certification as a CPIM (p. 4)	97%	3%	84%	16%
K. Certification as a CFPIM—Fellow (p. 4)	97%	3%	83%	17%
L. Other: (Specify below.)				
.....	----	-----	------	------

2. This part of the questionnaire is about your score report. Please answer Questions I and II separately about information provided on your score report. (Check YES or NO for Question I and Question II on each line.)

INFORMATION INCLUDED ON YOUR SCORE REPORT	QUESTION I: WERE YOU ABLE TO IDENTIFY/LOCATE THIS INFORMATION ON YOUR SCORE REPORT? YES	QUESTION I: NO	QUESTION II: DOES THE PROVIDED INFORMATION HELP YOU TO IDENTIFY TEST CONTENT AREAS FOR ADDITIONAL STUDY? YES	QUESTION II: NO
A. Your Subscores	99%	1%	77%	23%
B. Your Total Test Scores	98%	2%	67%	33%
C. Your Pass/Fail Outcome	99%	1%	67%	33%
D. Your Diagnostic Scores	98%	2%	78%	22%
E. Other: (Specify below.)				
_____	_____	_____	_____	_____

THE REMAINDER OF THE QUESTIONNAIRE IS ABOUT THE CAPACITY MANAGEMENT EXAMINATION.

3. If you were preparing to take the Capacity Management examination for a second time, on which diagnostic content would you concentrate your studies? (Check as many as apply.)

A. Diagnostic 1	53%
B. Diagnostic 2	75%
C. Diagnostic 3	37%
D. Diagnostic 4	62%
E. Diagnostic 5	55%

Why? _____

_____

_____

4. Are you planning to take the Capacity Management examination again? (Check YES or NO.)

YES 38% NO 62%

3. This page of the questionnaire is about your preparation for each diagnostic content area of the Capacity Management examination. Check as many boxes that apply separately for Question I and Question II, on each line.

		Question I: Which study activities did you perform to prepare for the Capacity Management exam?					Question II: Which study activities would you perform if you were preparing to take the Capacity Management exam for a second time?				
		DIAGNOSTIC					DIAGNOSTIC				
	STUDY ACTIVITY	1	2	3	4	5	1	2	3	4	5
A.	Attend/attended an APICS seminar or workshop	33%	33%	32%	33%	33%	42%	43%	41%	42%	41%
B.	Attend/attended a non-APICS seminar or workshop	10%	10%	10%	10%	10%	9%	9%	9%	9%	9%
C.	Participate/participated in an informal study group	9%	9%	9%	9%	9%	18%	18%	17%	18%	18%
D.	Study/studied on your own, not with a group	78%	77%	77%	77%	76%	66%	66%	65%	66%	65%
E.	Attend/attended a regular college course	9%	9%	9%	9%	9%	6%	5%	6%	5%	5%
F.	Study/studied the references listed in the Study Guide	51%	49%	50%	49%	48%	60%	61%	58%	60%	59%
G.	Other: (Specify below.)										

Note. Entered in each box is the percentage of candidates in the analysis sample who entered a check mark in the box.

6. Did you pass the Inventory Management examination at the certification level? (Check YES or NO.)

YES 62% NO 38%

If you did NOT pass the Inventory Management examination at the certification level, why do you think you did not? Provide as many reasons as you feel are applicable.

THANK YOU FOR YOUR COOPERATION.

Please return the completed questionnaire in the enclosed, self-addressed, stamped envelope.

TABLES

Table 1

Return Rates for Score Interpretation Questionnaires Mailed to APICS Candidates Who Took the Inventory Management or the Capacity Management Certification Examination for the First Time in November 1985

	Inventory Management		Capacity Management	
	Return Rate	N	Return Rate	N
Questionnaires Returned	47%	416	55%	479
Questionnaires Mailed		877		876

Table 2

Representativeness of Analysis Samples of APICS Candidates Relative to Total Samples on Pass-Fail Status, Sex and Test Center Location

	Inventory Management			
	Analysis Sample (N=416)		Total Sample (N=877)	
	% of N	Category Subtotal	% of N	Category Subtotal
Pass-Fail Status				
Passed the Test	62%	258	56%	488
Failed the Test	38%	158	44%	389
Sex				
Male	73%	302	69%	604
Female	22%	92	26%	228
Unidentified	5%	22	5%	45
Test Center Location				
U.S.A.	90%	373	88%	774
Foreign	10%	43	12%	103
	Capacity Management			
	(N=479)		(N=876)	
Pass-Fail Status				
Passed the Test	62%	298	52%	457
Failed the Test	38%	181	48%	419
Sex				
Male	76%	364	72%	633
Female	20%	96	23%	199
Unidentified	4%	19	5%	44
Test Center Location				
U.S.A.	89%	427	89%	783
Foreign	11%	52	11%	93

Table 3

Percentage of APICS Candidates in the Inventory Management Analysis Sample Who Responded "Yes" to the Topics in Item 1 of the Score Interpretation Questionnaire---All Candidates in Sample (N=416)

	Question I		Question II	
	Is this Topic Explained Clearly in the Booklet?		Was the Treatment of this Topic in the Booklet Useful in Helping You Determine How Well You Performed on the Test?	
Topic	% Yes	Total Responses	% Yes	Total Responses
A. Total Scores: explanation of numbers	92%	411	89%	404
B. Subscores: explanation of numbers	90%	408	85%	401
C. Subscores: description of content	87%	407	83%	400
D. Diagnostic scores: explanation of numbers	88%	407	84%	402
E. Diagnostic scores: description of content	85%	406	79%	400
F. Passing scores at Fellow level	95%	408	90%	398
G. Passing score at Certification level	98%	406	93%	397
H. Equating	79%	404	64%	395
I. New Scale	72%	405	61%	394
J. Certification as a CPIM	97%	408	86%	396
K. Certification as a CFPIM--Fellow	96%	406	84%	392

Table 4

Percentage of APICS Candidates in the Capacity Management Analysis Sample Who Responded "Yes" to the Topics in Item 1 of the Score Interpretation Questionnaire---All Candidates in Sample (N=479)

	Question I		Question II	
	Is this Topic Explained Clearly in the Booklet?		Was the Treatment of this Topic in the Booklet Useful in Helping You Determine How Well You Performed on the Test?	
Topic	% Yes	Total Responses	% Yes	Total Responses
A. Total Scores: explanation of numbers	92%	466	85%	464
B. Subscores: explanation of numbers	88%	464	82%	466
C. Subscores: description of content	83%	462	77%	463
D. Diagnostic scores: explanation of numbers	90%	464	84%	467
E. Diagnostic scores: description of content	80%	465	75%	464
F. Passing scores at Fellow level	97%	464	86%	454
G. Passing score at Certification level	97%	466	88%	454
H. Equating	73%	459	60%	451
I. New Scale	69%	457	59%	453
J. Certification as a CPIM	97%	465	84%	449
K. Certification as a CFPIM--Fellow	97%	461	83%	447

Table 5

APICS Candidates' Perceptions of the Usefulness of Subscore and Diagnostic Score Information---Percentage of "Yes" Responses to Items 1BII, 1CII, 1DII, 1EII, 2AII and 2DII of the Score Interpretation Questionnaire for Passers (N=258), Failers (N=158) and All Candidates (N=416) in the Inventory Management Analysis Sample

Item 1 - Question II: Was the Treatment of this Topic in the Booklet Useful in Helping You Determine How Well You Peformed on the Test?

	Passers		Failers		All	
Topic	% Yes	Total	% Yes	Total	% Yes	Total
B. Subscores: explanation of numbers	90%	249	78%	152	85%	401
C. Subscores: description of content	88%	248	74%	152	83%	400
D. Diagnostic scores: explanation of numbers	86%	250	80%	152	84%	402
E. Diagnostic scores: description of content	80%	250	77%	150	79%	400

Item 2 - Question II: Does the Provided Information Help You to Identify Test Content Areas for Additional Study?

	Passers		Failers		All	
Topic	% Yes	Total	% Yes	Total	% Yes	Total
A. Subscores	84%	250	75%	153	81%	403
D. Diagnostic Scores	88%	248	79%	151	85%	399

Table 6

APICS Candidates' Perceptions of the Usefulness of Subscore and Diagnostic Score Information---Percentage of "Yes" Responses to Items 1BII, 1CII, 1DII, 1EII, 2AII and 2DII of the Score Interpretation Questionnaire for Passers (N=298), Failers (N=181) and All Candidates (N=479) in the Capacity Management Analysis Sample

Item 1 - Question II: Was the Treatment of this Topic in the Booklet Useful in Helping You Determine How Well You Peformed on the Test?

	Passers		Failers		All	
Topic	% Yes	Total	% Yes	Total	% Yes	Total
B. Subscores: explanation of numbers	87%	293	74%	173	82%	466
C. Subscores: description of content	81%	291	70%	172	77%	463
D. Diagnostic scores: explanation of numbers	87%	293	79%	174	84%	467
E. Diagnostic scores: description of content	78%	292	69%	172	75%	464

Item 2 - Question II: Does the Provided Information Help You to Identify Test Content Areas for Additional Study?

	Passers		Failers		All	
Topic	% Yes	Total	% Yes	Total	% Yes	Total
A. Subscores	79%	294	74%	175	77%	469
D. Diagnostic Scores	81%	293	74%	171	78%	464

Table 7

Means of Variables on Which Passed and Failed APICS Candidates Differed Strongly---Inventory Management Analysis Sample (N=416)

Variable Description	APICS Candidates: Passers (N=258) Mean %	Tot.	Failers (N=158) Mean %	Tot.
Performance Status on Diagnostic Part-test 1 - "Objectives and Decisions" (1=acceptable 0=unacceptable)[a]	66%	258	10%	158
Performance Status on Diagnostic Part-test 5 - "Indep. and Dep. Demand Inventory Systems" (1=acceptable 0=unacceptable)[a]	88%	258	28%	158
SIQ Item 1AII - Was Booklet Explanation of Total Test Scores Useful? (1=Yes 0=No)	93%	251	82%	153
SIQ Item 5DI - How Did Candidate Prepare for the Test? (1=Studied on own 0=Did not study on own)	80%	258	65%	158
SIQ Item 1BII - Was Booklet Explanation of Subtest Scoring Useful? (1=Yes 0=No)	90%	249	78%	152
SIQ Item 1CII - Was Booklet Explanation of Subtest Content Useful? (1=Yes 0=No)	88%	248	74%	152
Sex (1=Male 0=Female)	82%	246	68%	148
SIQ Item 1HI - Was Booklet Explanation of Equating Clear? (1=Yes 0=No)	83%	249	72%	155

Note. Variables are listed in descending order from the most strong to the least strong group difference, as defined by chi-square values (Yates-corrected). All chi-square values were significant at the 1% level.

[a] Diagnostic performance level 1 (i.e., "acceptable") consists of reported score categories 1 to 3 and level 0 (i.e., "unacceptable") consists of reported score categories 4 and 5.

Table 8

Means of Variables on Which Passed and Failed APICS Candidates Differed Strongly---Capacity Management Analysis Sample (N=479)

Variable Description	APICS Candidates: Passers (N=298) Mean %	Tot.	Failers (N=181) Mean %	Tot.
Performance Status on Diagnostic Part-test 5[a] - "Techniques of Control" (1=acceptable 0=unacceptable)	71%	298	4%	181
Performance Status on Diagnostic Part-test 3[a] - "Leadtime Management" (1=acceptable 0=unacceptable)	96%	298	59%	181
SIQ Item 1BII - Was Booklet Explanation of Subtest Scoring Useful? (1=Yes 0=No)	87%	293	74%	173
SIQ Item 1AII - Was Booklet Explanation of Total Test Scores Useful? (1=Yes 0=No)	90%	292	78%	172
SIQ Item 1CII - Was Booklet Explanation of Subtest Content Useful? (1=Yes 0=No)	81%	291	70%	172

Note. Variables are listed in descending order from the most strong to the least strong group difference, as defined by chi-square values (Yates-corrected). All chi-square values were significant at the 1% level.

[a] Diagnostic performace level 1 (i.e., "acceptable") consists of reported score categories 1 to 3 and level 0 (i.e., "unacceptable") consists of reported score categories 4 and 5.

Table 9

Study Activities Performed by Passed and Failed APICS Candidates in Preparation for the Inventory Management Test (N=416)

Study Activity	% of Cands. Who Performed the Activity to Prepare for the Nov. 1985 Testing	% of Cands. Who Would Perform the Activity if Restested	Net % Change in Study Strategy[a]
Passed Candidates (N=258)			
APICS Seminar	47%	43%	- 4%
non-APICS Seminar	10%	9%	- 1%
Study Group	13%	22%	+ 9% *
Studying on Own	80%	71%	- 9% *
College Course	15%	9%	- 6% *
Study Guide Refs.	48%	61%	+13% *
Failed Candidates (N=158)			
APICS Seminar	38%	39%	+ 1%
non-APICS Seminar	12%	8%	- 4%
Study Group	19%	23%	+ 4%
Studying on Own	65%	66%	+ 1%
College Course	13%	11%	- 2%
Study Guide Refs.	42%	58%	+16% *

[a] Percentage of candidates who indicated they would perform the study activity if retested (col. 2) minus the percentage who indicated they performed the activity to prepare for the November 1985 testing (col. 1).

* $p<.01$, two-tailed (dependent t-test with N-1 degrees of freedom).

Table 10

Study Activities Performed by Passed and Failed APICS Candidates in Preparation for the Capacity Management Test (N=479)

Study Activity	% of Cands. Who Performed the Activity to Prepare for the Nov. 1985 Testing	% of Cands. Who Would Perform the Activity if Restested	Net % Change in Study Strategy[a]
Passed Candidates (N=298)			
APICS Seminar	32%	41%	+ 9% *
non-APICS Seminar	12%	10%	- 2%
Study Group	10%	19%	+ 9% *
Studying on Own	81%	67%	-14% *
College Course	9%	5%	- 4%
Study Guide Refs.	54%	65%	+11% *
Failed Candidates (N=181)			
APICS Seminar	38%	47%	+ 9%
non-APICS Seminar	8%	9%	- 1%
Study Group	9%	18%	+ 9% *
Studying on Own	75%	69%	- 6%
College Course	11%	7%	- 4%
Study Guide Refs.	49%	59%	+10%

[a] Percentage of candidates who indicated they would perform the study activity if retested (col. 2) minus the percentage who indicated they performed the activity to prepare for the November 1985 testing (col. 1).

* $p<.01$, two-tailed (dependent T-test with N-1 degrees of freedom).

Table 11

Percentage of Passed and Failed APICS Candidates Who Interpreted Their Deficient Diagnostic Results Correctly ---Inventory Management and Capacity Management Analysis Samples

	Inventory Management			
	Passers (N=258)		Failers (N=158)	
Diagnostic Part-test	% Interp. Correctly	Total Def.	% Interp. Correctly	Total Def.
1 - "Objectives and Decisions"	75%	89	73%	143
2 - "Accounting and Control Inventory Management and Business Functions"	75%	55	72%	114
3 - "Inventory Systems Devel.	78%	82	79%	139
4 - "Lot-Size Inventory Models"	74%	96	72%	140
5 - "Indep. and Dep. Demand Inventory Systems"	72%	32	74%	114
6 - "Distribution Inventory Mgmt."	78%	102	74%	148
	Capacity Management			
	Passers (N=258)		Failers (N=158)	
1 - "Concepts, Application and System Interfaces"	82%	99	76%	152
2 - "Capacity Determination"	83%	198	84%	180
3 - "Lead-time Management"	75%	12	75%	75
4 - "Techniques of Planning"	79%	130	79%	165
5 - "Techniques of Control"	74%	86	79%	155

Note 1. A correct interpretation of a deficient diagnostic result is the combination of earning a diagnostic part-test score of 4 or 5 and identifying the diagnostic content as an area to be emphasized if studying for a retesting (Item 3 of the Score Interpretation Questionnaire).

Note 2. None of the Chi-square tests (Yates-corrected) comparing passing and failing candidates were significant at the 5% level.

Table 12

[a]

Comparision of Mean Test Scaled Scores of APICS Candidates Who Failed in November 1985 and Retested in April or July 1986---Inventory Management and Capacity Management Repeater Samples

November 1985 Testing			April/July 1986 Retesting			
	Test Scaled Score			Test Scaled Score		Mean Test Score
% Passing	Mean	SD	% Passing	Mean	SD	Gain
Inventory Management (N=50)						
0%	59.4	5.0	50%	64.8	7.6	+5.4
			[b] r=.846			
Capacity Management (N=66)						
0%	58.5	5.2	42%	63.0	7.3	+4.5
			[b] r=.807			

Note. The numbers of candidates retested in April and July, respectively are 42 and 8 for Inventory Management and 58 and 8 for Capacity Management.

[a] Inventory Management and Capacity Management test scores are reported on a scale that ranges from 20 to 95, with a passing score of 65 required for certification.

[b] These numbers are Pearson Product-Moment correlations between November 1985 and April/July 1986 test scaled scores, corrected for restriction in range of the November test scores. Both correlations are significant at the 1% level, two-tailed test with N-2 degrees of freedom.